

Radiological Recommendations

Applicable to the Demolition of Dickson Warehouse

1.0 Basis and Scope

The following recommendations are based upon a review of data as presented in the Remedial Action Report (RAR) for the Dickson Warehouse (URS, Inc., 2007-2008). No isotopic data was available for review; only gross alpha and gross beta measurements were presented. The site-wide cleanup levels establish radionuclides of concern as thorium-230 (Th-230) and Th-232, and radium-226 (Ra-226) and Ra-228. Of these, Th-232, Th-230, and Ra-226 are alpha emitters. Ra-228 is a beta emitter. As members of natural decay series, the entire decay chain of daughter nuclides is likely present to some extent. The daughters include both alpha and beta emitters.

Without isotopic data, conservative assumptions were made regarding the source of the alpha and beta activities. For example, Th-232 represents the most restrictive nuclide in terms of derived airborne concentrations (DAC) limits; therefore, to evaluate potential airborne hazards, all alpha activity was attributed to Th-232. Likewise for beta, all activity was attributed to Ra-228. For waste acceptance criteria, again, the most restrictive nuclide was chosen.

One final assumption made was that the structural materials are inherently clean and were only contaminated by the former operations on the site. Therefore, any residual contamination is considered to be limited to the surfaces (< 1 cm) of the materials only.

The recommendations contained herein apply strictly to the demolition of the Dickson Warehouse. Additionally, the recommendations only address radiological considerations; other potential hazards are not addressed.

2.0 Summary of Radiological Conditions

MARSSIM-based final status surveys were performed over the following building surfaces:

- Floors (Class 1)
- Lower Interior Walls (Class 1)
- Upper Interior Walls (Class 2)
- Exterior walls (combination of Class 1 and Class 2)
- Roof (combination of Class 1 and Class 2)

There is no record of a survey being performed on the ceiling of the warehouse.

The Null Hypothesis was rejected for all survey units thereby indicating that all survey units meet release criteria. However, several survey units contained individual alpha and/or beta fixed activity measurements that exceeded the Unrestricted Release Criteria. During the final status survey evaluation, these elevated measurements were successfully resolved using the Wilcoxon Rank-Sum (WRS) test and/or the elevated measurement comparison (EMC) test. A summary of the fixed and removable measurements is presented in the following sections.

2.1 Fixed Contamination

The uncertainty associated with the fixed contamination measurements was relatively high, typically on the order of +/- 50%. For evaluating the potential extent of fixed surface area contamination, data were evaluated using both the measured value and the upper 95% confidence interval value. Both values were compared against the Unrestricted Release Criteria (see table footnote). The percentage of surface area that may exceed criteria is expected to fall somewhere between the two extremes (~21-45%). The breakdown per building location type is presented in Table 1:

Table 1: Percentage of surface areas potentially containing fixed contamination above criteria.

Location	Percentage of Above-Criteria Measurements ¹	Percentage of 95% UCI Measurements Above Criteria ¹	Maximum Alpha Measurement ²	Maximum Beta Measurement ²
Exterior Walls (SU 1)	9%	36%	483	1712
Interior Lower Walls (SU 2-5)	33%	59%	247	2369
Interior Upper Walls (SU 6-7)	10%	21%	295	973
Interior Floor (SU8)	19%	42%	221	1415
Roof (SU 9)	36%	68%	229	3001
Average:	21.4%	45.2%	295	1894

1. All evaluations performed on net data; background values were subtracted prior to comparison with criteria. Criteria is equal to:
 - a. 100 dpm/100 cm² Alpha, above background (background varies with material)
 - b. 1000 dpm/100 cm² Beta, above background (background varies with material)
2. Units in dpm/100 cm²; data presented as net above background.

2.2 Removable Contamination

There was no indication that above-criteria removable contamination is located on any building surface. The maximum values of removable contamination per location are shown in Table 2.

Table 2: Maximum results for removable contamination.

Location	Maximum Alpha Measurement ¹	Alpha Removable Criteria	Maximum Beta Measurement ¹	Beta Removable Criteria
Exterior Walls (SU 1)	9.93	20	92.6	200
Interior Lower Walls (SU 2-5)	4.75	20	38.6	200
Interior Upper Walls (SU 6-7)	2.07	20	51.76	200
Interior Floor (SU8)	9.65	20	109	200
Roof (SU 9)	16.16	20	97	200
Average percentage of Criteria:	43%		39%	

1. Measurements are gross activity in dpm/100 cm².

3.0 Conclusions and Recommendations

The survey results indicate that all survey units were below the established unrestricted release criteria with no radiological restrictions. The biggest concern during demolition is the potential for generating airborne contamination in the form of dust particles. However, the projected severity of this is low based on the source term and environmental considerations. Another concern is the potential concentration of radioactive materials that could create radiation fields on transport vehicles could that alarm disposal facility portal monitors. The projected severity or frequency of this occurrence is also low based on the characteristics of the nuclides and their concentrations. Keeping in mind that the building has been unconditionally released by the EPA, and in consideration of the aforementioned potential hazards, the following recommendations are made in order to help ensure that demolition activities are in compliance with applicable regulations and are protective of workers, the general public, and the environment.

Recommendations:

- 1.) **Dust control** during demolition, material handling, staging, and loading activities. Dust represents the single greatest hazard, by controlling dust, we greatly reduce the potential for internal uptakes and effluent (offsite) exceedances.
- 2.) **Perimeter air monitoring** to document the airborne conditions and to confirm compliance with offsite effluent release limits. Four perimeter monitors located based on wind rose predictions, but generally spaced one in each cardinal direction.
- 3.) **Pre-Job Site Surveys**
 - a. Pre-work dose rate surveys to establish baseline conditions
 - b. Routine job coverage dose rate surveys to monitor changing conditions
 - c. Stockpile dose rate survey to document changing conditions
 - d. Final Survey of work areas after completion
- 4.) **Equipment Surveys:**
 - a. Incoming
 - b. Free release after completion
- 5.) **Personnel Surveys:** Employees should frisk out when leaving the area.
- 6.) **Material Surveys:** Due to the fact that there are no documented surveys of the ceiling, and that a large percentage of Class 2 surveys were not subjected to scanning, it is recommended that a routine method of surveying building material be established.
- 7.) **Transportation Surveys:** Packages (i.e., dump trucks) should be subject to transportation surveys including dose rate and removable contamination surveys.
- 8.) **Personal Protective Equipment:** Modified Level D (Modified as needed for preventing dermal contact). No respiratory protection needed so long as dust is controlled.
- 9.) **Training:** Site-specific general employee training to include discussion of radiological hazards.

- 10.) **Postings:** No special posting requirements are needed, however, it is recommended that a boundary be established around all work areas to facilitate safe work practices and prevent potential migration of contaminated materials.
- 11.) **Final Status Survey:** The soil beneath the warehouse should be subject to a FSS following completion of demolition activities; a radium plume seems to extend under the northern side of the building. In any event, FSS will be required for final site closeout.